

Shipyard Marking Methods

U.S. Department of Commerce
Maritime Administration

in cooperation with
Avondale Shipyards, Inc.
New Orleans, Louisiana

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FOREWORD

THIS PROJECT WAS PERFORMED UNDER THE NATIONAL SHIP-BUILDING RESEARCH PROGRAM, THE PROJECT, AS PART OF THIS PROGRAM, IS A COOPERATIVE COST SHARED EFFORT BETWEEN THE MARITIME ADMINISTRATION, BETHLEHEM STEEL CORPORATION (SPARROW'S POINT SHIPYARD) AND AVONDALE SHIPYARDS, INC, THE OVERALL OBJECTIVE OF THE PROGRAM IS IMPROVED PRODUCTIVITY AND, THEREFORE, REDUCED SHIPBUILDING COSTS TO MEET THE LOWER CONSTRUCTION DIFFERENTIAL SUBSIDY RATE GOALS OF THE MERCHANT MARINE ACT OF 1970,

THE STUDIES HAVE BEEN UNDERTAKEN WITH THIS GOAL IN MIND, AND HAVE FOLLOWED CLOSELY THE PROJECT OUTLINE APPROVED BY THE SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS' (SNAME) SHIP PRODUCTION COMMITTEE, THE RESEARCH EFFORT FOR THE PROJECT WAS ASSIGNED, BY SUBCONTRACT, TO BETHLEHEM STEEL CORPORATION (SPARROW'S POINT SHIPYARD),

MR, HUGH PECK SERVED AS PROJECT MANAGER FOR BETHLEHEM STEEL CORPORATION WHILE MR, JOHN PEART, OF AVONDALE SHIPYARDS, INC., WAS THE R & D PROJECT MANAGER RESPONSIBLE FOR TECHNICAL DIRECTION, EDITING AND PUBLICATION OF THE FINAL REPORT. PROGRAM DEFINITION AND GUIDANCE WAS PROVIDED BY THE MEMBERS OF THE 023-1 SURFACE PREPARATION COATINGS COMMITTEE OF SNAME, MR, C, J, STARKENBURG, AVONDALE SHIPYARDS, INC., CHAIRMAN,

SPECIAL THANKS ARE ALSO GIVEN FOR THE SUPPORT OF MR, JACK GARVEY AND MR, ROBERT SCHAFFRAN, OF THE MARITIME

ADMINISTRATION , AND THE CONTRIBUTIONS OF THE FOLLOWING
CORPORATIONS:

ALABAMA DRY DOCK AND SHIPBUILDING Co., MOBILE, ALABAMA

AVONDALE SHIPYARDS, INC., NEW ORLEANS, LOUISIANA

BATH IRON WORKS CORPORATION, BATH, MAINE

BAY SHIPBUILDING CORPORATION , STURGEON BAY, WISCONSIN

BETHLEHEM STEEL CORPORATION, BEAUMONT, TEXAS

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BETHLEHEM STEEL CORPORATION, SINGAPORE

BRISTOL STEEL AND IRON WORKS, INC., BRISTOL, VIRGINIA

DRAVO CORPORATION, PITTSBURGH, PENNSYLVANIA

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HIGH STEEL STRUCTURES , LANCASTER, PENNSYLVANIA

INGALLS SHIPBUILDING, PASCAGOULA, MISSISSIPPI

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MARYLAND SHIPBUILDING AND DRYDOCK Co., BALTIMORE, MARYLAND

MAXON MARINE INDUSTRIES, INC., TELL CITY, INDIANA

MARE ISLAND NAVAL SHIPYARD, VALLEJO, CALIFORNIA

NATIONAL STEEL AND SHIPBUILDING Co., SAN DIEGO, CALIFORNIA

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MOBIL CHEMICAL COMPANY, EDISON, NEW JERSEY
JOHN P , NISSEN, JR., Co., GLENSIDE, PENNSYLVANIA
THE PANNIER CORPORATION, PITTSBURGH, PENNSYLVANIA
PHILLIPS PROCESS Cot, ROCHESTER, NEW YORK
SPRAYON PRODUCTS, INC., BEDFORD HEIGHTS, OHIO
TEMPIL DIVISION, BIG THREE INDUSTRIES, SOUTH PLAINFIELD,
NEW JERSEY,
WEBER MARKING SYSTEMS, INC., ARLINGTON HEIGHTS, ILLINOIS

EXECUTIVE SUMMARY

THE PRIMARY OBJECTIVE OF THIS PROJECT WAS TO ESTABLISH METHODS AND MATERIALS AVAILABLE FOR MARKING STEEL PLATES AND SHAPES WITH INSTRUCTIONS AND IDENTIFICATION SO THAT SUCH MARKINGS NEED NOT BE REMOVED PRIOR TO TOPCOATING, A PRIME CRITERIA IN CHOSING THE MATERIALS WAS THE COMPATIBILITY OF OVERCOATS WITH SUCH MARKINGS AND THE DURABILITY OF THE MARKING MATERIALS THEMSELVES,

THE SECOND OBJECTIVE WAS TO DETERMINE THE COLOR CODING SYSTEMS BEING USED BY THE SHIPYARDS TO IDENTIFY MATERIALS AND TO ATTEMPT TO FORMULATE AN INDUSTRY ACCEPTABLE STANDARD, THE RESULTS OF THESE EFFORTS ARE AS FOLLOWS:

1. PIGMENTED INORGANIC ETHYL SILICATE VEHICLE MARKING MATERIALS WERE FOUND TO BE SUPERIOR, THEY ARE BOTH DURABLE AND ARE RECRATABLE WITH ALL STANDARD MARINE TOP COATINGS, SEE FIGURE 1,2,
2. THEY CAN BE SUCCESSFULLY PACKAGED AND APPLIED ON A PRODUCTION BASIS BY THE USE OF BALL POINT POLY-ETHYLENE BOTTLES, SEE FIGURE 1,3,
3. PAINT TYPE MARKING MATERIALS, SUCH AS NISSEN AND TEMPIL MARKERS, LEAVE RAISED IMPRESSIONS WHICH ARE VISIBLE THROUGH SEVERAL LAYERS OF TOPCOATS, SEE FIGURE 1,1, ALSO, MOST UTILIZED PAINT TYPE MARKERS ARE SENSITIVE TO THE STRONGER SOLVENTS USED IN CHLORINATED RUBBER AND EPOXY COATINGS, AND LIFTING OR WRINKLING OF THE MATERIAL OCCURS,

4, A SHIPYARD SURVEY DETERMINED THAT MANY MATERIAL COLOR CODING SYSTEMS ARE BEING USED BY THE INDUSTRY; STANDARDIZATION OF SUCH MARKING CAN BEST BE ACCOMPLISHED ON A CONSENSUS BASIS BY THE F-25 MARINE STANDARDS COMMITTEE OF THE AMERICAN SOCIETY OF TESTING MATERIALS (ASTM),

IF STEEL MARKING IS ACCOMPLISHED BY THE MATERIAL AND METHOD IDENTIFIED HEREIN A CONSIDERABLE COST SAVINGS COULD BE EFFECTED BY ELIMINATING COATING FAILURES AND REWORK NECESSARY THROUGH THE USE OF IMPROPER MARKING MATERIALS AND/OR METHODS OF APPLICATION,

THE PIGMENTED INORGANIC ETHYL SILICATE MATERIALS ARE AVAILABLE BUT CAN NOT BE OBTAINED PREPACKAGED IN THE BALL POINT TIPPED POLYETHYLENE BOTTLES. SEE FIGURE 1,3, SUFFICIENT INTEREST MUST BE GENERATED BY THE INDUSTRY TO JUSTIFY A SUPPLIER IN PACKAGING THESE MATERIALS AS REQUIRED.

EFFORTS TO ACCOMPLISH THIS WILL BE IMPLEMENTED BY THE PROGRAM MANAGER,

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(213) 879-1575 | ENGRAVE-O-MARK PENS |

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(412) 362-6500</p> | <p>INKS
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CHICAGO, ILLINOIS 60612</p> | <p>PAINT
POLYETHYLENE BOTTLES</p> |
| <p>18. WEBER MARKING SYSTEM, INC .
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60005
(312) 439-8500</p> | <p>INKS</p> |
| <p>19. THE LECTROETCH Co,
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| <p>20. CARBOLINE MARINE CORPORATION
350 HANLEY COURT
ST, LOUIS, MO, 63144
(314) 644-1000</p> | <p>INORGANIC COLORS</p> |
| <p>21. AMERON-PROTECTIVE COATINGS DIV,
201 NORTH BERRY STREET
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800-854-3118</p> | <p>INORGANIC COLORS</p> |

22 , INTERNATIONAL PAINT Co,
MORRIS AND ELMWOOD AVENUES
P. O., BOX 386
UNION, NW JERSEY 07083
(201) 686-1300

4437 SINGLE PKG,
EPOXY PRIMER

23 .NEWPORT NEWS SHIPBUILDING
& DRY DOCK Co,
NEWPORT NEWS, VA, 23607

PAINT MARKING TUBES

24 , THEARO CORPORATION
ONE ARO CENTER
BRYAN, OHIO 43506
(419) 636-4242

MARXAL AIR OPERATED
MARKING PEN

25 .HOSEI
1-8-14 NISHI MIYAHARA
YODOGAWA-KU, OSAKA

FOGPEN - IN K

26 .MAGIC MARKER CORP,
1 MAGICMARKER LANE
CHERRY HILL, N, J, 08003
(609) 424-5880

PAINT - POLYETHYLENE
BOTTLES

27 .MOBIL CHEMICAL
P. O, Box 250
EDISON, NEW JERSEY 08817
(201) 287-2626

UNIPAK PRECONSTRUCTION
PRIMER IN COLORS

SECTION 1

CONCLUSIONS

1. CONCLUSIONS

1. PROJECT RESULTS

THE RESULTS AND CONCLUSIONS OF THIS REPORT ARE SUMMARIZED BELOW:

1. A SURVEY, SENT TO INDUSTRY, DETERMINED THE METHODS USED FOR IDENTIFICATION AND INSTRUCTION MARKINGS OF STEEL PLATES AND STRUCTURAL AS WELL AS WHAT TYPE OF COLOR CODING WAS BEING USED. CONCURRENTLY WITH THE SURVEY, TESTS WERE CONDUCTED TO DETERMINE THE SUITABILITY OF SPECIFIC MARKING MATERIALS UNDER WEATHERING CONDITIONS. CONCLUSIONS ATTAINED FROM BOTH THE TESTS AND THE SURVEY, WERE AS FOLLOWS:

- A. FOR OVERCOATING, THE INKS AND THE INORGANIC ETHYL SILICATE PIGMENTED MATERIALS PERFORMED MOST SUCCESSFULLY
- B. PAINT TYPE MARKING MATERIALS LEAVE RAISED IMPRESSIONS THAT ARE VISIBLE THROUGH TOPCOATS, (SEE FIGURE 1,1),
- C. NISSEN METAL MARKERS, WHICH ARE THE MOST COMMONLY USED MARKERS BY SHIPYARDS, WERE INCOMPATIBLE WITH FOUR OF THE SIX COATING SYSTEMS TESTED.

MARKERS OF THIS TYPE ALSO LEFT

RAISED IMPRESSIONS WHICH WERE VISIBLE AFTER TOPCOATING, MAKING THEM AESTHETICALLY UNSATISFACTORY,

D. PAINT STICK TYPE MARKERS WERE THE LEAST SATISFACTORY PERFORMERS IN THE OVERCOATING TESTS, FAILING IN ALL TOPCOAT TESTS,

E. PIGMENTED INKS AND DYES PROVED DIFFICULT TO OVERCOAT, IN MANY CASES TOPCOATS HAD POOR ADHESION TO THESE Materials

F. INKS, EXCEPT THE PIGMENTED TYPES, AND DYES HAVE A TENDENCY TO FADE WHEN EXPOSED TO SUNLIGHT, IN GENERAL, THESE MATERIALS ARE DIFFICULT TO READ ON INORGANIC ZINC PRIMERS BECAUSE THEY ARE ABSORBED INTO THE FILM,

G. THE INORGANIC ETHYL SILICATE TYPE OF MARKERS PROVED TO BE THE BEST OVER ALL UNDER ALL TEST CONDITIONS. ONE OF THE PROBLEMS ENCOUNTERED WITH THESE MATERIALS WAS FINDING A SUITABLE APPLICATION METHOD OR DEVICE FOR SHIPYARD USE, FINALLY, ATTEMPTS TO INCORPORATE THE MATERIAL INTO VARIOUS DEVICES AVAILABLE LED TO THEIR SUCCESSFUL INCORPORATION INTO BALL

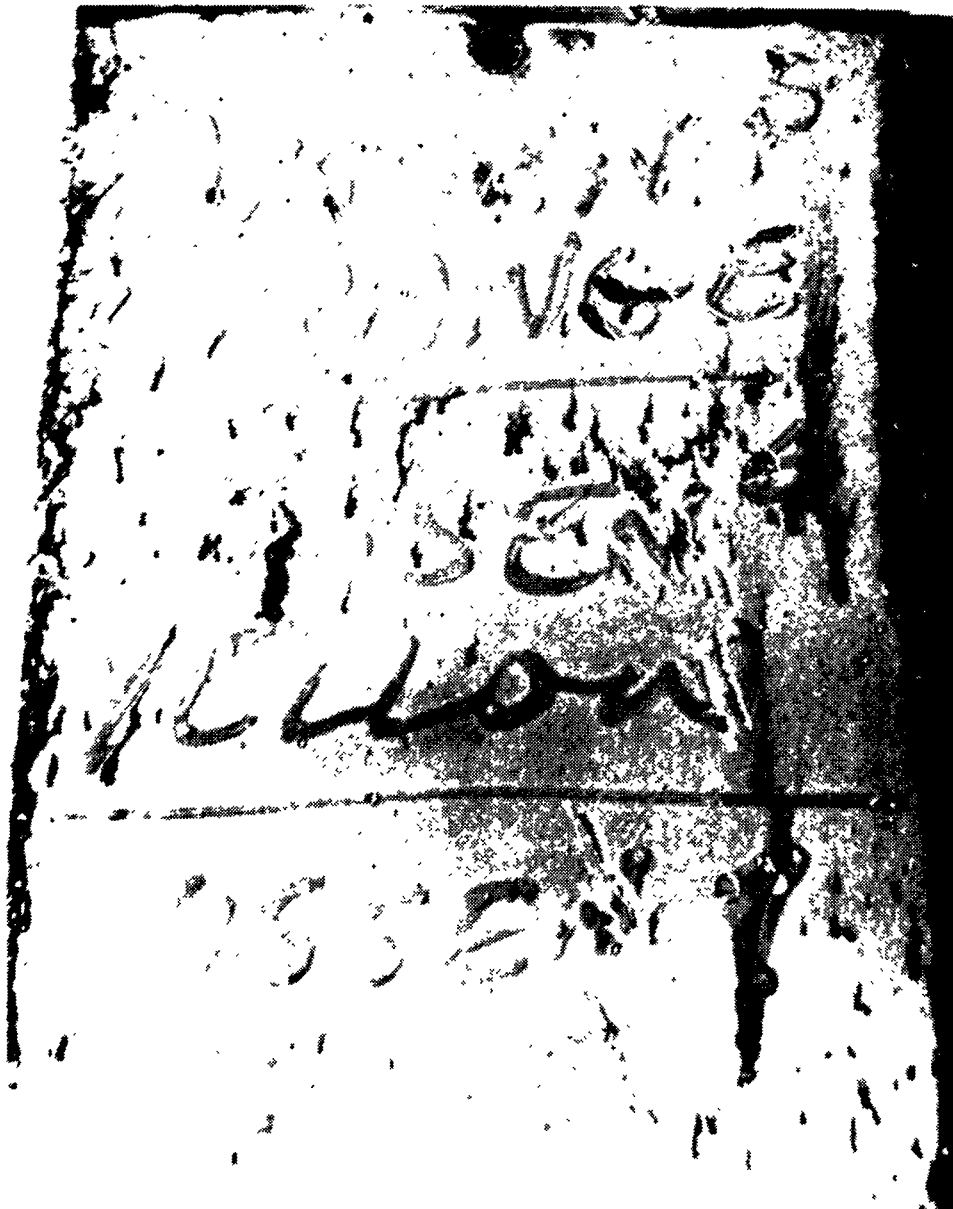


FIGURE 1.1 - EXAMPLE OF RAISED IMPRESSION THROUGH SEVERAL LAYERS OF PAINT.

POINT POLYETHYLENE BOTTLES,

H. THE MARKAL MATERIALS HAD ACCEPTABLE PERFORMANCE UNDER ALL COATING SYSTEMS TESTED EXCEPT CHLORINATED RUBBER, THESE MATERIALS HELD UP VERY WELL ON EXTERIOR EXPOSURE WHEN APPLIED TO INORGANIC ZINC PRIMERS AND VINYL BUTYRAL WAS PRIMERS, HOWEVER, THEY DID NOT PERFORM SATISFACTORILY OVER EPOXY PRIMERS,

I. ELT TIP MARKERS WERE INVESTIGATED AND A SUITABLE TYPE, WITH HEAVY DUTY REPLACEABLE TIPS AND REFILLABLE FLUID SUPPLY, WAS OBTAINED, THIS DEVICE PROVED EXCELLENT FOR USE WITH VERY THIN FLUIDS SUCH AS INKS) DYES) AND MARKING MATERIALS WITH LOW PIGMENTATION,

J. IT WAS DETERMINED THAT MOST MARKING DEVICES CAN NOT ACCOMMODATE OVERHEAD MARKING, FOR THIS PURPOSE THE BALL POINT SQUEEZE TUBES, PAINT BRUSH AND PAINT STICKS WERE THE ONLY SUITABLE ALTERNATIVES FOR FELT TIP TYPE MARKERS PRESSURING WOULD BE REQUIRED FOR OVERHEAD APPLICATIONI

K. ONE OF THE MOST SURPRISING RESULTS

OF THE TESTS WAS THE FACT THAT OVER COATING THESE MARKING MATERIALS WITH ETHYL SILICATE INORGANIC ZINCS DID NOT, IN GENERAL, PRODUCE THE POOR RESULTS THAT WOULD BE EXPECTED WHEN OVERCOATING ORGANIC MARKS WITH INORGANIC ZINC COATINGS,

L. ONE WIDELY USED MARKING APPLICATION METHOD WAS FOUND TO BE THE USE OF AEROSOL CANS CONTAINING PAINTS OF VARIOUS TYPES,

1,2 CONCLUSIONS FROM SURVEY

THE SURVEY WAS CONDUCTED IN TWO PARTS EACH OF WHICH WAS SENT TO THE INDUSTRY, THE FIRST PART INVOLVED QUESTIONS ON MATERIALS USED AND THE METHODS OF APPLICATION, THE SECOND PART DEALT WITH COLOR CODING,

1 , 2 , 1 MARKING MATERIALS AND METHODS

THE RESULTS OF THESE SURVEYS ARE AS FOLLOWS:

A, IT WAS FOUND THAT THE MAJORITY OF COMPANIES USE A COMBINATION OF MATERIALS FOR MARKING, AMONG THE MOST FREQUENTLY USED WERE A COMBINATION OF PAINT, SOAP STONE AND CRAYONS,

B, THE MOST COMMONLY USED METHOD OF PAINT APPLICATION FOR MARKING WAS BY MEANS OF BALL POINT TUBES, SEE FIGURES 1, 2 AND 1,3,

FIGURE 1.2 - INORGANIC
MARKING MATERIAL IN
POLYETHYLENE BOTTLE



FIGURE 1.3 - BALL POINT
POLYETHYLENE BOTTLES



- C, OF ALL THE YARDS SURVEYED IT WAS FOUND THAT 72% ARE USING THE SAME COLOR FOR MARKING BY ALL TRADES
- D. APPROXIMATELY HALF OF THE YARDS SURVEYED CLAIM THAT THE MARKING MATERIALS ARE COMPATIBLE WITH THE TOPCOATS THAT ARE BEING USED, THE SAME NUMBER OF YARDS DO NOT REMOVE THE MARKINGS PRIOR TO APPLYING THE TOPCOATING,
- E. WHEN MARKINGS ARE REMOVED BY THE SHIPYARD, THE MOST COMMON METHOD USED IS ABRASIVE SWEEPING
- F. TINTING OF PRIMERS FOR UNIVERSAL COLOR CODING DOES NOT APPEAR TO BE A SATISFACTORY METHOD SINCE 33% OF THE YARDS SURVEYED DO NOT USE PRECONSTRUCTION PRIMERS, 33% USE A SINGLE PRECONSTRUCTION AND 33% VARY PRECONSTRUCTION PRIMERS IN ACCORDANCE WITH THE SPECIFIC CONTRACT
- G, FOR THE MAJORITY OF YARDS APPLYING A PRECONSTRUCTION PRIMER INORGANIC ZINC TYPES ARE THE MOST COMMONLY USED, TO ACHIEVE A COLOR STANDARD WITH THESE COATINGS IS IMPRACTICAL BECAUSE THE MANUFACTURERS USE DIFFERENT COLORS FOR THEIR BASE PRODUCTS,

H, MOST OF THE YARDS USING COLOR CODED STEEL USE ORGANIC PAINTS FOR THAT PURPOSE AND FOLLOW ASTM DESIGNATIONS FOR STEEL TYPE COLORS,

1.3 CONCLUSIONS FROM TESTS

TESTS CONDUCTED INCLUDED BOTH SALT FOG TESTS AND EXTERIOR EXPOSURE TESTS, CONCLUSIONS FROM THESE TESTS WERE AS FOLLOWS:

A, THE INORGANIC BASED MARKING MATERIALS PROVED TO HAVE THE BEST PROPERTIES OVERALL, THEY HELD UP WELL UNDER EXTERIOR EXPOSURE CONDITIONS AND PERFORMED SATISFACTORY IN TOPCOAT COMPATIBILITY WITH ALL COATING SYSTEMS TESTED, SINCE THESE MATERIALS PROVED TO HAVE THE MOST DESIRABLE PROPERTIES ONE OF THE PRIME OBJECTIVES OF THIS PROJECT WAS TO FIND A SUITABLE CONTAINER TO USE WITH THE INORGANIC MARKING MATERIALS, AS A RESULT, THESE MATERIALS HAVE BEEN SUCCESSFULLY INCORPORATED INTO BALL POINT POLYETHYLENE MARKERS, SUPPLIERS OF INORGANIC BASED MARKING MATERIALS HAVE EXPRESSED INTEREST IN THE PACKAGING OF (OR HAVING PACKAGED) THESE MATERIALS IN POLYETHYLENE BOTTLES, SOME OF THESE BOTTLES HAVE A SPONGE INCORPORATED INTO THE CAP WHICH WIPES THE TIP EACH TIME IT IS REPLACED,

SECTION 2

PROJECT PLAN OF ACTION & RESULTS

2. PROJECT PLAN OF ACTION & RESULTS

2.1 OBJECTIVES

THE OBJECTIVES OF THIS PROGRAM WERE TWOFOLD, FIRST, THE REMOVAL OF MATERIALS PRIOR TO TOPCOATING APPLICATION HAS BEEN A COSTLY OPERATION FOR THE SHIPYARDS, METHODS AND MATERIALS WERE TO BE DETERMINED THAT WOULD NOT NECESSITATE THIS, SECONDLY, THE MULTITUDE OF MATERIAL CODING SYSTEMS IN USE HAS BROUGHT ABOUT CONFUSION AND COSTLY MISTAKES, TOWARDS THIS END A STANDARD CODING SYSTEM WAS INVESTIGATED, THIS STUDY ADDRESSES THESE PROBLEMS AS FOLLOWS:

2.2 GENERAL APPROACH

PHASE I OF THE PROJECT WAS TO QUERY THE INDUSTRY AND THEREBY DETERMINE WHAT MARKING MATERIALS AND METHODS WERE BEING USED, THE METHODS OF APPLICATION AND THE ACCEPTABILITY OF THE SYSTEM BY THE BUILDER, ALSO, WHAT COLOR CODING METHODS WERE BEING USED AND THE SPECIFIC PROBLEMS RELATED TO THE USE OF SUCH MARKINGS, PHASE II WAS THE TESTING AND EVALUATION OF THE VARIOUS MARKING MATERIALS AND THEIR METHODS OF APPLICATION, MATERIALS TESTED INCLUDED:

- | | |
|-----------|---------------------------------|
| 1. PAINT | 5. PAINT STICKS |
| 2. DYES | 6. PIGMENTED INORGANIC VEHICLES |
| 3. INKS | |
| 4. STAINS | 7. PIGMENTED INKS |

2.2.1 MARKING METHODS AND MATERIALS TESTED

MANY TYPES OF COMMERCIALY AVAILABLE MARKING METHODS WERE TRIED, THE VARIOUS MATERIALS, AND THE TRADE NAME UNDER WHICH EACH KNOWN, IS LISTED BELOW, (FOR THE COMPLETE ADDRESS AND NAME OF THE SPECIFIC MARKETING COMPANY, SEE THE LIST OF SUPPLIERS ON PAGE VII)

1. POLYETHYLENE BOTTLES WITH STEEL BALL POINT TIPS, (MARKAL, DIAGRAPH, MAGIC MARKER)
2. SQUEEZE TUBES WITH STEEL BALL POINT TIPS, (NISSEN, TEMPIL, NEWPORT NEWS SHIPBUILDING)
3. SELF FEEDING BRUSH PENS, (CARCO)
4. FELT TIP MARKER, PERMANENT TIP, (SANDORD, DIXON)
5. FELT TIP MARKER, REPLACEABLE TIP, RE-FILLABLE INK SUPPLY, (MARSH, CARCO)
6. POLYETHYLENE BOTTLE WITH PRESSURE 'FED FOUNTAIN BRUSH, (DYKEM)
7. PAINT STICK, (MARKAL, DIXON)
8. BRUSH, (PENAMARK, DYKEM)

SEVERAL EXAMPLES OF THESE MATERIALS AND THEIR APPLICATION METHODS ARE SHOWN IN FIGURES 2,1 THROUGH 2,4,



FIGURE 2.1 - BALL POINT
SQUEEZE TUBES



FIGURE 2.2 - SELF FEEDING
BRUSH PENS

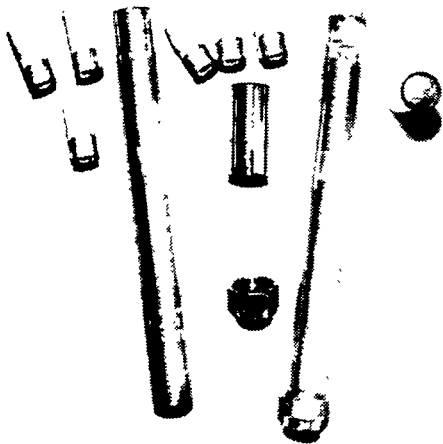


FIGURE 2.3 - REPLACEABLE
FELT TIP PENS

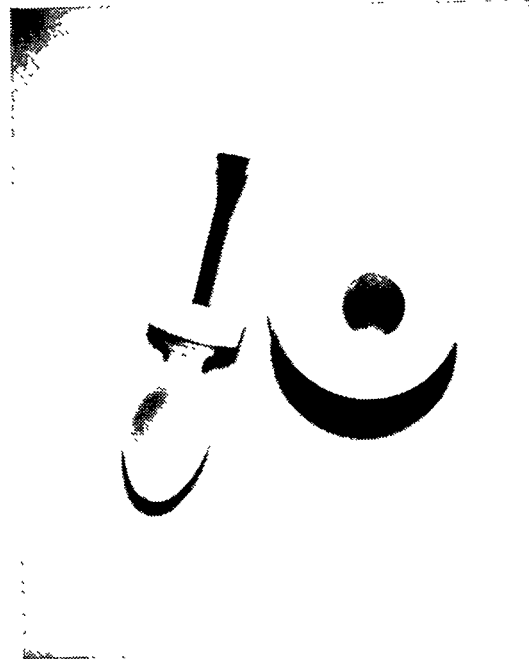


FIGURE 2.4 - POLYETHYLENE
BOTTLE WITH PRESSURE FED
BRUSH

2.2.1.1 RESULTS OF SURVEY

THE FOLLOWING TWO PART INQUIRY WAS SENT TO VARIOUS SHIPYARDS AND STEEL FABRICATING COMPANIES TO DETERMINE WHAT MARKING AND CODING METHODS WERE CURRENTLY IN USE, PART ONE INVOLVED MARKING METHODS WHILE PART TWO INVESTIGATED CODING, THE NUMBERS AFTER EACH QUESTION INDICATES THE NUMBER OF AFFIRMATIVE RESPONSES GIVEN TO THE PARTICULAR QUESTION:

INQUIRY PART ONE--MARKING METHODS

1. WHAT MARKING METHODS ARE USED BY TRADES IN YOUR COMPANY?
 - A. STEEL LETTER AND NUMERICAL PUNCHES (6)
 - B. PAINT (21)
 - c, CHALK (7)
 - D, SOAPSTONE (13)
 - E. INK (5)
 - F. CRAYON OR PAINT STICK (14)
 - G. DYE (1)
 - H. PENCIL (1)
 1. ELECTRIC ENGRAVING (1)
2. WHO MANUFACTURES THE MARKING MATERIALS USED IN YOUR COMPANY?
 - A. YOUNG BROS, STAMPWORKS, MUSCATINE, IOWA
 - B. JOHN P. NISSEN, JR, GLENSIDE, PA, (11)
 - c. JOSEPH DIXON CRUCIBLE Co., JERSEY CITY, N, J, (9)

- D. SANFORD COMPANY, BELWOOD, ILLINOIS (2)
- E. INTERNATIONAL PAINT Co., UNION, N, J,
- F. MARKAL Co., CHICAGO ILLINOIS (6)
- G. RUSTOLEUM (2)
- H. PITTSBURGH PLATE GLASS Co., (1)
- I. JOHNSON PAINT Co., PITTSBURGH, PA, (1)
- J. NATAHOLA, C, B, CRYSTAL Co., NEW YORK, N, y, (1)
- K. MAB PAINT Co., (1)
- L. ST, LOUIS CRAYON & CANDLE Co., (1)
- M. BEROL CORPORATION, DANFORD, CONN, (1)
- N. MID-WEST CRAYON WORKS, ST, LOUIS, Mo, (1)
- O. MARSH STENCIL MACHINE COMPANY (1)
- P. FABER-CASTELL, INC., NEWARK, N, J, (2)
- Q. PACIFIC AEROSOL, INC., SAN LEANDRO, CALIF, (1)
- R. IDEAL STENCIL MACHINE Co., BELLEVILLE, ILL, (1)
- S. NEWPORT NEWS SHIPBUILDING (1)
- T. CROWN INDUSTRIAL PRODUCTS Co, (1)
- U. SHERWIN WILLIAMS (1)

3. WHAT TYPE OF MATERIAL (S) IS USED FOR MARKING?

- | | |
|---------------|--------------------|
| A. PAINT (19) | E. CRAYON (7) |
| B. INK (5) | F. STEEL STAMP (2) |
| C. STAIN (0) | G, CHALK (2) |
| D. DYE (1) | H, SOAPSTONE (4) |

4. WHAT TYPE OF DISPENSING METHOD IS UTILIZED WITH MARKING MATERIALS?

- | | |
|---------------------------------|-----------------------|
| A. BALL POINT TUBE (13) | H, STEEL STAMP (2) |
| B, BALL POINT POLY BOTTLE (3) | 1. FELT TIP PEN (4) |

- | | |
|---------------------|--------------------------|
| c. BRUSH (4) | J. ROLLER (2) |
| D, CRAYON (15) | K. SPRAY CAN (6) |
| E. CHALK (9) | L, BAMBOO PEN & INK POT |
| F. SOAPSTONE (12) | M. OIL PENCIL (1) |
| G. LAC STICK (0) | N. ELECTRIC ENGRAVER (1) |

5, ARE STANDARD COLORS USED FOR VARIOUS TRADES OR DO ALL TRADES USE THE SAME COLORS?

- A. SAME COLOR (13)
- B, STANDARD COLORS (4)
- C. ONLY INSPECTORS USE DIFFERENT COLORS (1)

6. WHAT TESTING METHODS WERE EMPLOYED IN DETERMINING THE SUITABILITY OF THE MARKING MATERIALS USED?

- A. MANUFACTURERS RECOMMENDATION (1)
- B. FIELD TRIAL (13)
- c, LABORATORY (3)
- D. NONE (3)"

7, ARE MATERIALS COMPATIBLE WITH CURRENTLY USED TOPCOATS?

- As YES (8)
- B, EXPERIENCED BLEED THROUGH (1)
- c, MARKS ARE RAISED (1)
- D, MARKS ARE REMOVED (3)
- E, No (7)

8. ARE MATERIALS COMPATIBLE WITH STEEL AND/OR CURRENTLY USED PRECONSTRUCTION PRIMERS?

- A, YES (15)
- B, No REBLASTED (1)
- c, NOT ALWAYS (1)

9. IF INCOMPATIBILITY EXISTS, WHAT REMOVAL PROCEDURE IS FOLLOWED PRIOR TO TOPCOATING?
- A. ABRASIVE SWEEPING OR ABRASIVE BLASTING (8)
 - B, NOT REMOVED (7)
 - C . SOLVENTS (3)
 - D, WIRE BRUSH OR HAND TOOLS (3)
 - E. SEALER APPLIED (2)
10. ESTIMATE THE COST SAVINGS ASSOCIATED WITH USING A MATERIAL FOR MARKING THAT WOULD NOT REQUIRE REMOVAL PRIOR TO TOPCOATING WITH ANY COATING MATERIAL.
- A. 1-2% OF BLASTING COST (1)
 - B. SEVERAL HOURS ON 12' x 30' PLATE (1)
 - c. **\$20,000 (1)**
 - D, CONSIDERABLE (1)
 - E. COST OF LABOR, THINNER, RAGS, STAGING (1)
 - F. 700-800 MANHOURS PER VESSEL (1)
 - G. CAN EASILY RUN IN EXCESS OF \$50,000 YEARLY DE-PENDING ON AMOUNT OF STEEL WORK DONE (1)
- 11, ADDITIONAL COMMENTS OR SUGGESTIONS WHICH COULD BE USEFUL IN SELECTING MARKING MATERIAL AND APPLICATION MEDIA,
- A, MATERIAL SHOULD BE WELDABLE AND NON-TOXIC WHEN BURNED
 - B, PRESSURE SENSITIVE TAPE WITH INFORMATION WRITTEN ON TAPE,
 - c. MARKINGS ON PLATE TOPS AND EDGES,
 - D. NEED REFILLABLE MARKERS,

- 1, A MARKING PAINT OR MATERIAL IS NEEDED THAT IS COMPATIBLE WITH INORGANIC ZINC AS WELL AS ORGANIC TOPCOATS .

INQUIRY PART TWO--COLOR CODE STANDARDIZATION:

1. ARE PLATES AUTOMATICALLY ABRASIVE BLASTED?
A. YES (14) B. No **(10)**
2. ARE SHAPES AUTOMATICALLY ABRASIVE BLASTED?
A. YES (15) B. No **(10)**
3. ARE PLATES AUTOMATICALLY COATED OR ARE THEY HAND
SPRAYED?
A, AUTOMATICALLY (10) B, HAND (13)
4. ARE SHAPES AUTOMATICALLY COATED OR ARE THEY HAND
SPRAYED?

- A, AUTOMATICALLY (7) B, HAND (14)
5. ARE PLATES AND SHAPES PROCESSED THROUGH THE SAME OR DIFFERENT UNITS?
- A. SAME (13) B. DIFFERENT (4)
6. IF A PRECONSTRUCTION PRIMER IS USED, WHAT IS THE GENERIC TYPE?
- As EPoxY (3) D, RED LEAD PRIMER (1)
- B. INORGANIC ZINC (10) E, VINYL BUTYRAC WASH
- C. ALKYD-ZINC CHROMATE PRIMER (1)
- (3)
7. IF A PRECONSTRUCTION PRIMER IS USED, WHO IS THE MANUFACTURER?
- A, AMERON (2) E, PORTER (2)
- B, INTERNATIONAL (7) F, ATLAS PAINT& VARNISH (1)
- C. BLP (1) G. MoBIL (1)
- D. KANSAI PAINT (1) H. DEVOE (1)
8. ARE DIFFERENT STEEL GRADES COLOR CODED FOR IDENTIFICATION?
- As YES (**18**) B.No (4)
9. WHAT COLOR STANDARDS ARE USED IF STEEL IS COLOR CODED?
- As (1) A131-MILD-ABS GRADE A, B, C, CS-RED
- (2) A212-BOILER & PRESSURE VESSEL-HI-TEMP-BLACK
- (3) A514-517-SSS100 EXTRA HI STRENGTH-GREY
- (4) HY80-NAVY MIL-S-16216-GREEN
- (5) A441-MARIGAVVERSE VANADIREM TRI-TEN
- SHEFFIELD HI STRENGTH "B"- LIVE
- (6) HT-NAVY MIL-5-16113-BLUE

B.	(1)	GRADE A	MILD STEEL	WHITE STRIPING
	(2)	GRADE B	MILD STEEL	YELLOW STRIPING
	(3)	GRADE C S	MILD STEEL	ORANGE STRIPING WITH BLACK HASH MARKS
	(4)	GRADE DS	MILD STEEL	ORANGE STRIPING
	(5)	AH-36	H _i T _i S _i	OLIVE STRIPING
	(6)	A517F	HIGH YIELD	RED HASH MARKS
C,	(1)	ASTM A-537		WHITE
	(2)	ASTM A-36		RED-WHITE
	(3)	ASTM A-572 GR,42 MODIFIED		GREEN-BLUE
	(4)	ASTM A-512 GR, 55		ORANGE-WHITE
	(5)	ASTM A-283 GR, C		GREEN-WHITE
	(6)	ABS GRADE DS NORMALIZED		BROWN
	(7)	ABS GRADE DS NORMALIZED		BROWN-PURPLE
		MIN YIELD 36 KSI		
	(8)	ABS GRADE EH-36		ORANGE
	(9)	ABS GRADE EH-36		GREEN
	(10)	ABS GRADE EH-32		Y E L L O W
	(11)	ABS GRADE AH-36		BLUE
D .	(1)	ASTM STANDARDS		
E.	(1)	ARS		GREEN
	(2)	T-1		RED
	(3)	A-441 TRITEN		YELLOW
	(4)	1045 & HIGHER		BLUE (ROUNDS)
	(5)	CORTEN A-588, A-242		YELLOW GREEN
	(6)	4140		YELLOW BLUE

	(7)	ASTRALLOY	YELLOW WHITE
	(8)	WEARALLOY	YELLOW RED
	(9)	40/50	BLUE WHITE (PLATE)
	(10)	EXTEN	WHITE GREEN
	(11)	MAYARI	RED GREEN
	(12)	AR-360	WRITTEN ON GREEN BACK- GROUND
	(13)	AR-400	WRITTEN ON GREEN BACK- GROUND
	(14)	AR-321	WRITTEN ON GREEN BACK- GROUND
	(15)	4340	WHITE
	(16)	2%	ORANGE
	(17)	KFG	PINK
	(18)	KFG 2%	ORANGE & PINK
F.	(1)	A	BLACK
	(2)	B	WHITE
	(3)	C	RED
	(4)	CN	GREEN
	(5)	ASTM	YELLOW
	(6)	DH	GRAY
	(7)	EH	PINK
	(8)	CS	B L U E
G.	(1)	ASTM STANDARDS	
H.	(1)	MILD STEEL	YELLOW
	(2)	HTS	GREEN
	(3)	HY80	BROWN

I.	(1)	MILD STEEL	YELLOW
	(2)	HTS	GREEN
	(3)	STS	RED
	(4)	HY80	BROWN
J.	(1)	HY80	PINK
	(2)	COR-TEN	ORANGE
K.	(1)	HY80	BROWN
	(2)	REMAINDER YELLOW	
L.	(1)	MILD STEEL MI L-S-22698	YELLOW
	(2)	HTS MI L-S-24094	DARK GREEN
	(3)	HY80 MI L-S-16216	BROWN
	(4)	HY100 MI L-S-16216	DARK BROWN
	(5)	STA MI L-S-20154	RED
	(6)	HY90	BROWN
		ASP	LIGHT BLUE
		NON-MAGNETIC	BLACK

M. (1) INGALLS SHIPBUILDING MANUFACTURING STANDARD
PROCESS,

10. IF COLOR CODING IS USED, WHAT IS THE MODE OF APPLICATION?

- A. TINTING PASTE ADDED AT JOB SITE TO PRIMER (2)
- B, TINTING PASTE ADDED BY PAINT COMPANY AT FACTORY (4)
- C . ZIG ZAG LINES, STRIPING, OR OTHER CONFIGURATION
ADDED AT AUTOMATIC UNIT (3)
- D. SASH BRUSH OR ROLLER (2)
- E. SPRAY CAN-MANUAL APPLICATION (11)

11. IF COLOR CODING IS UTILIZED, IS COLOR PERMANENCE

SATISFACTORY FOR IDENTIFICATION AFTER EXTERIOR EX-
POSURES OF SIX TO EIGHT MONTHS?

A. YES (15)

B. No (3)

12. IS A SINGLE PRECONSTRUCTION PRIMER USED OR DOES THE
PRIMER VARY BY CONTRACT?

A. SINGLE PCP (7)

B. VARIES BY CONTRACT (9)

C. Do NOT USE (7)

13. ADDITIONAL COMMENTS OR SUGGESTIONS WHICH COULD BE
USEFUL IN STANDARDIZING A COLOR CODE FOR STEEL IDEN-
TIFICATION.

A. WE ARE CONTEMPLATING COORDINATING OUR OWN COLOR
CODING WITH THAT USED BY ASTM TO AVOID CON-
FUSION AT THE MILL WHERE OURS DIFFER FROM A6, AT
THE PRESENT THE COLOR CODE FOR STEEL FOR US IS TO
OUR OWN CODE, WHEN REQUESTED, EVEN IF IT DIFFERS
FROM A6.

B. DEVELOP UNIVERSAL COLOR CODE SYSTEM FOR STRUCTURAL
AND ABS GRADE STEELS THAT CAN BE UTILIZED WITH
VARIOUS CONSTRUCTION PRIMERS WITH NECESSARY TINT
ING MATERIALS.

C. THE PRINCIPLE OF COLOR CODING BY THE INDUSTRY WITH
CERTAIN STANDARDS APPEARS VERY HELPFUL.

D. SHOULD BE DONE AT STEEL MILL, AROUND ALL EDGES AND
ZIG-ZAG THROUGH MAJOR SURFACE AREAS,


E. PAINT USED FOR IDENTIFICATION PURPOSES SHOULD BE
COMPATIBLE WITH ALL OTHER PAINT APPLICATIONS SUCH

AS EPOXY, VINYL, ETC., AND SHOULD BE A BASE PRIMER FOR ALL OTHER COATINGS.

F. COLORS USED SHOULD VARY ENOUGH TO BE READILY RECOGNIZABLE. (SOME COLORS USED DO NOT HAVE ENOUGH VARIANCE TO BE EASILY DISTINGUISHABLE FROM EACH OTHER)

2.2.1.2 TYPICAL INDUSTRY STANDARD

A. INGALLS SHIPBUILDING COMPANY'S STANDARD PROCESS FOR MARKING STEEL AND ALUMINUM PLATES AND SHAPES, ON A PARTICULAR CONTRACT, IS SHOWN ON THE FOLLOWING PAGES, THIS IS A TYPICAL STANDARD USED BY ONE COMPANY, BUT. IT COULD VERY WELL BE USED TO INITIATE AN INDUSTRY WIDE STANDARD.

 INGALLS SHIPBUILDING Litton	APPROVED BY: L. N. Waddell <i>L. N. Waddell 4/25/77</i>	MSP NO. 904-016	REV: A
	CONCUR: H. F. Rosscup <i>H. F. Rosscup</i>	DATE EFFECTIVE: 2 May 1977	
MANUFACTURING STANDARD PROCESS (MSP)		PAGE: 1 OF 4	
	AUTHENTICATED: R. J. Negrotto <i>R. J. Negrotto</i>	PREPARED BY: G. W. Moore <i>G. W. Moore</i>	
TITLE ALUMINUM, MILITARY CONTRACTS, COLOR CODING OF			

A. PROCESS

1. To ensure that the Naval requirement is met for aluminum (plates and shapes) identification throughout storage and fabrication, and that the system provides the means of identification of material from receipt to assembly build-up.
2. Identify the incoming aluminum as it is received against the purchase order, bill of-lading, or other receiving document. Determine the color code to be applied by comparing the receiving data with the specification number and description appearing in Table I and IL

Denotes change

TABLE I (PLATE)

<u>DESIGNATION/GRADE</u>	<u>COLOR</u>	<u>SPECIFICATION</u>	<u>DESCRIPTION</u>
LA	Yellow	QQ-A-250-20	5456H116 or 117
LC	Blue	QQ-A-250-10C	5454H34
AA	Red	QQ-A-250-8D	5052-H22 or H32
AE	Green	QQ-A-250-9	5456H112
AF	Black	MIL-F-17132	6061TY Floor Plate Rolling Pattern B
GD	Light Grey	QQ-A-250-19	5086H112
LP	Orange	QQ-A-250-7D	5086H32
LE	Purple	QQ-A-250-19	5086H116
LV	Brown	QQ-A-250-9	5436H321
LO	Olive	QQ-A-250-11	6061T651
LM	Ivory	QQ-A-250-11D	6061T6
ML	Dark Grey	QQ-A-250-7	5086H112

TABLE II (SHAPES)

<u>DESIGNATION/GRADE</u>	<u>COLOR</u>	<u>SPECIFICATION</u>	<u>DESCRIPTION</u>
LB	Yellow	QQ-A-200-7C	5456H111
LD	Blue	QQ-A-200-6	5454H111
LN	Red	QQ-A-200-8C	6061T6
LF	Green	QQ-A-200-5	5086H111

3. All Iranian material will be color coded with a gold stripe in addition to the regular color coding.

4. After the plate or shape has been delivered to its first "resting place" along the line, apply the proper color paint corresponding to the pilot spot color.

CAUTION

Safety precaution, as specified in the LSS Safety Manual, shall be observed during all painting operations.

A. IDENTIFICATION OF PLATES

1. Using an aerosol spray can coat each of the two (2) corners of plates on the side facing "UP", (See Figure 1).

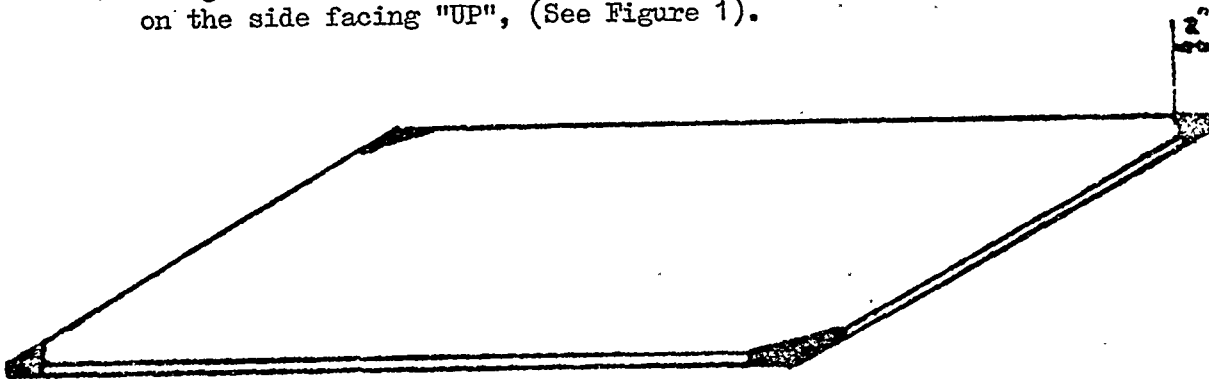


FIGURE 1

B. IDENTIFICATION OF SHAPES (Angles, "T" and I beams, channels and flat bars)

1. Using an aerosol can apply a coating on one end section (approximately 2 inches) on both the outside and inside of the shapes, (See Figure 2).

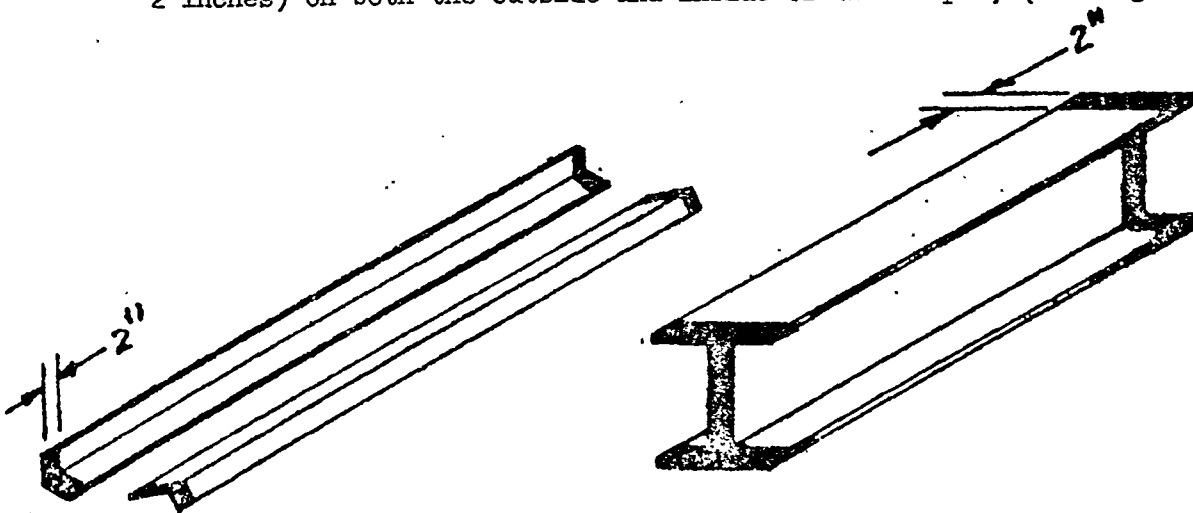


FIGURE 2



C. IDENTIFICATION OF SMALL PARTS AND MATERIAL


1. Small parts, plates, and shapes shall be identified by letter designation Table I and II.

D. QUALITY ASSURANCE PROVISIONS

1. The Receipt Inspector shall verify application of proper color code during receipt inspection.
2. The in-process inspector shall verify that all applicable material is color coded.
3. If an inspector finds any applicable material that is not color coded or improperly coded, a Nonconformance Record, form F-187, shall be prepared in accordance with S.P. 16210.65.

E. CORRECTIVE ACTION

1. Reidentify all material to approved documents when either original identification was incorrect or through lost identity. On material to be reidentified remove all previous traces of coloring with approved solvents or steel wire brushes before applying new color coding.

 INGALLS SHIPBUILDING	APPROVED BY: <i>M. Waddell</i> 7/30/76	MSP NO: 904-007	REV: F
	CONCUR: <i>H. F. Rosscup</i> 7/30/76	DATE EFFECTIVE:	
MANUFACTURING STANDARD PROCESS (MSP)	H. F. Rosscup 7/30/76	PAGE: 1	OF: 6
	AUTHENTICATED:	PREPARED BY: T. Luckey <i>T. Luckey</i>	
TITLE STEEL, MILITARY CONTRACTS, COLOR CODING OF (LHA AND DD)			

A. PROCESS

1. To ensure that the Naval requirement is met for steel (plates and shapes) identification throughout storage and fabrication, and that the system provides the means of identification of material from receipt to assembly build-up. The Quality Assurance Plan for LHA-1 Class Ship specifies that a color code system shall be used.
2. Identify the incoming steel as it is received against the Purchase Order, Bill of Lading, or other receiving document. Determine the code color to be applied by comparing the receiving data with the specification number and description appearing in Table I.

TABLE I

<u>DESIGNATION</u>	<u>COLOR</u>	<u>SPECIFICATION</u>	<u>DESCRIPTION</u>
WA	Orange	MIL-S-24113A (Modified)	Material under $\frac{1}{2}$ inch thick to be furnished as rolled, tensile to be 90,000 PSI maximum. Charpy impacts to be waived on thickness over $\frac{1}{2}$ inch to $\frac{5}{8}$ inch excl. Supplier to perform nonductility testing of material $\frac{5}{8}$ inch thick and heavier in lieu of Charpy impacts per paragraphs 4.6.3 and 4.5.3 line E of Amendment # 1 - above.
XB	Olive	ASTM-A441	Plates & Shapes USS: Tri-Ten Sheffield: H1-Strength "B" Yoloy: A441 Republic: A441
XC	Dark Gray	ASTM-A242	Plates & Shapes USS: Corten, Sheffield: H1-Strength "A" Republic: 50
AX	Purple	ASTM-A242	Type 2 Structural Steel Channel, A242 Typ. 50,000 PSI yield, 70,000 PSI tensile, ultimate percentage of elongation not required.
XD	Green	MIL-S-20166	Steel Structural Shapes; Weldable Medium Carbon and High Tensile; Hull & Structural - Grade HT Type U
XE	Green	MIL-S-16113C	Steel Plates, High Tensile (HT) Hull and Structural Type I, Class U
XH	Brown	MIL-S-16216	Steel Plates, Alloy, Structural, High Yield Strength HY-80
MM	Red	ASTM-A36	Steel Shapes, MM Grade Steel.

XJ	Yellow	MIL-S-20166	Steel Structural Shapes; Weldable Medium Carbon and High Tensiles; Hull and Structural - Grade M Type U
XK	Blue	MIL-S-20154	High Yield Plates HY-100
XL	Red	MIL-S-22698A	Steel Plate, Carbon Structural, for Ships, Type 1 Class A, B, or C as Rolled
HC	Red and Ivory	MIL-S-22698A	Steel Plate Carbon Structural, for Ships, Type 1 Class D as Rolled

NOTE

The second color shall be applied adjacent to the first.

XP	Red	ASTM-A131	Mild Steel Shapes
XU	Brown XY-80	MIL-S-22664 (Ships)	Steel, Alloy, Extrusions, Structural Shapes (HY-80 and HY-100)
XU	Blue HY-80	MIL-S-22664 (Ships)	Steel, Alloy Extrusions (HY-80 and HY-100)
XY	Brown HY-80	MIL-S-22958	Steel, Alloy, Shapes Hot Rolled Structural (HY-80 and HY-100)

NOTE

Bars only

XY	Blue HY-100	MIL-S-22958	Steel, Alloy Shapes Hot Rolled, Structural (HY-80 and HY-100)
XX	Black	ASTM-A537	Fire Box Quality, Impact Testing Requirements same as for Type A Steel

XY	Ivory	ASTM-A517	Charpy V-Notch Impact Valve of 15 LBS at - 50°F Transverse Impact Test from each Plate as Rolled, Testing, to be Witnessed by ABS Surveyor
GR	Black and Ivory	QQ-S-691C	Steel Plate, Carbon-1 Silicon, Carbon Molybdenum Alloys Hot Rolled, (Marine Boiler Quality) Class "E"

3. All in-process material received undergoes a cleaning process through the wheelabrator, prior to cutting. All rust and previous markings will be removed at this operation. After the cleaning is accomplished, a pilot color spot shall be applied immediately to the material for later identification.

NOTE

Close attention must be given to the proper selection of the pilot color spot at this point. Incorrect pilot color spot will result in incorrect color coding, resulting in loss of material identity.

- 4 . After the plate or shape has been delivered to its first "resting place" along the line, apply the proper color paint corresponding to the pilot spot color.

CAUTION

Safety precautions, as specified in the LSS Safety Manual, shall be observed during all painting operations.

3. IDENTIFICATION OF PLATES

1. Using an aerosal spray can coat each of the four (4) corners of plates on the side facing "UP", (See Figure 1).

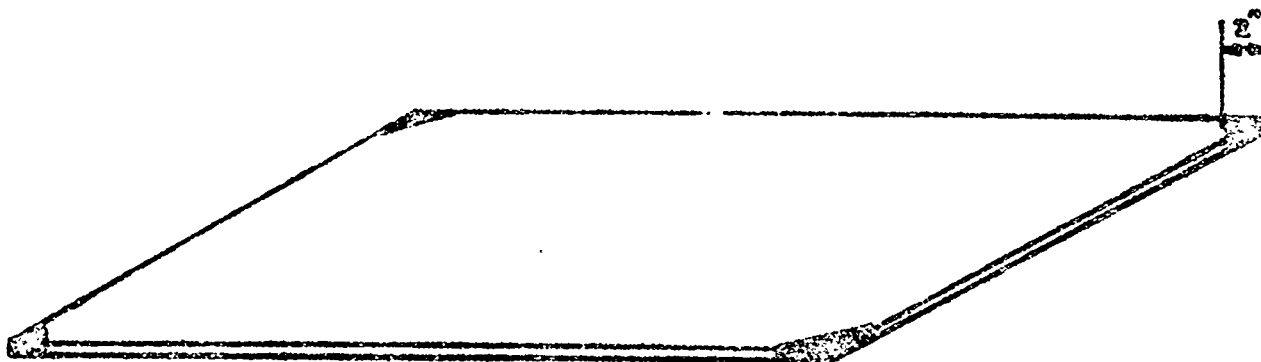


FIGURE 1

C. IDENTIFICATION OF SHAPES (Angles, "T" and I beams, channels and flat bars)

1. Using an aerosol can apply a coating to each end section (approximately 2 inches) on both the outside and inside of the shapes, (See Figure 2).

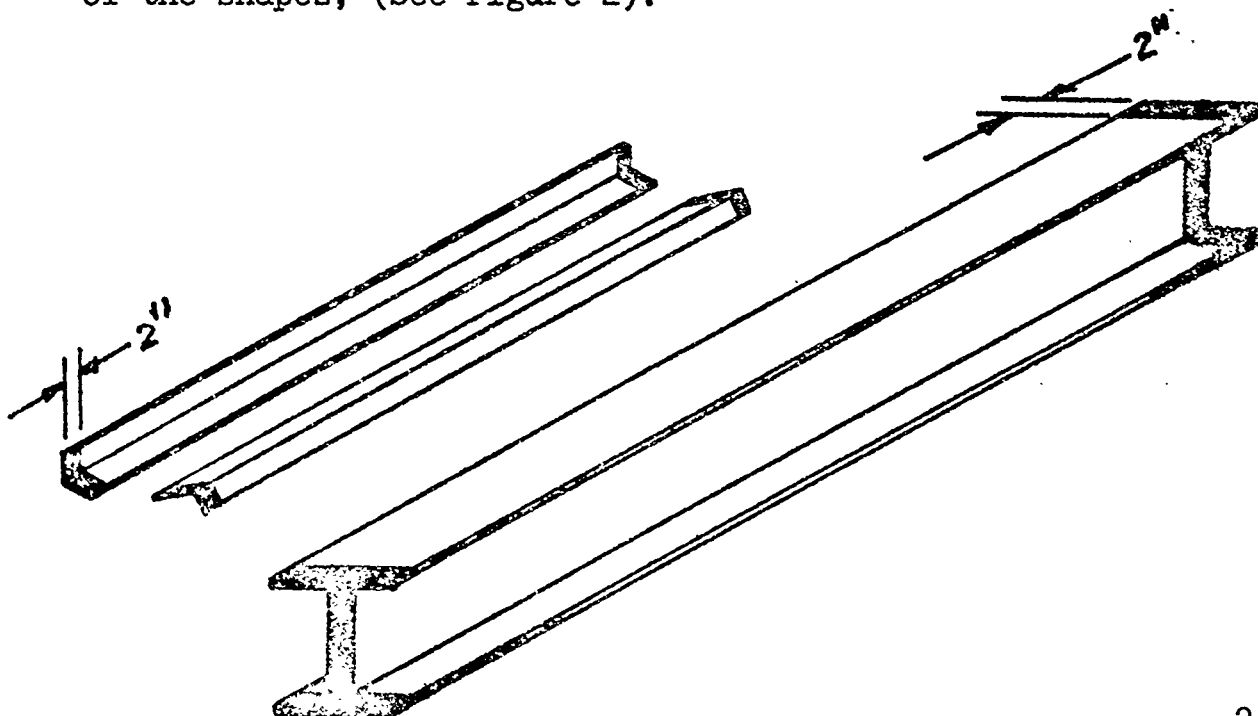


FIGURE 2

D. IDENTIFICATION OF SMALL PARTS AND MATERIAL

1. Small parts, plates, and shapes shall be identified as per section B and C as required.

E. QUALITY ASSURANCE PROVISIONS

1. The Receipt Inspector shall verify application of **proper color code during receipt inspection.**
2. **The in-process inspector shall verify that all applicable material is color coded,**
3. **If an inspector finds any applicable material that is not color coded or improperly coded, a Deficiency Report shall be prepared in accordance with Operating Instruction 704-1.2 "Use of Deficiency Report".**

F. CORRECTIVE ACTION

1. **Reidentify all material to approved documents when either original identification was incorrect or through lost identity. On material to be reidentified remove all previous traces of coloring with approved solvents or steel wire brushes before applying new color coding.**

2.2.2 EXPOSURE TESTS

TABLE 1, IN THIS REPORT, IS A LISTING OF THE TOPCOATING TESTS USING THE TYPES OF COATINGS COMMON TO THE MARINE INDUSTRY OVER VARIOUS TYPES OF MARKING MATERIALS. EACH OF THE NUMBERED PANELS INDICATED IN THE TABLE WERE EXPOSED IN A SALT FOG CHAMBER FOR **2,500** HOURS, AFTER WHICH THE ADHESION OF EACH WAS TESTED BY PROBING WITH A KNIFE, A RATING SYSTEM FROM TEN TO ZERO WAS USED, WITH TEN BEING EXCELLENT ADHESION AND ZERO INDICATING A COMPLETE FAILURE. ANY RATING BELOW SEVEN WAS CONSIDERED TO BE UNSATISFACTORY, ALL MARKING WAS DONE ON PANELS PRIMED WITH INORGANIC ZINC PRECONSTRUCTION PRIMER.

THE FOLLOWING COATING SYSTEMS WERE TESTED AS TOPCOATING MATERIALS OVER ALL MARKS:

1. WASH PRIMER/SILICONE ALKYD
2. CATALYZED EPOXY
3. CHLORINATED RUBBER
4. SINGLE PACKAGE EPOXY/SILICONE ALKYD
5. BITUMINOUS ALUMINUM FILLED
6. INORGANIC ZINC

DURING THE TEST SIX MARKING MATERIALS PERFORMED SATISFACTORILY. IN ADDITION, THREE OTHER MARKING MATERIALS HAD ONLY ONE FAILURE.

TABLE 2 INDICATES THE PERFORMANCE OF MARKING MATERIALS IN THE SALT FOG STUDY AND RELATES WHETHER THE PERFORMANCE WAS ACCEPTABLE OR UNACCEPTABLE. TABLE 3 RATES THE SYSTEM TESTED AND SHOWS WHEN FAILURES WERE NOTED. TYPICAL FAILURES THAT OCCURRED DURING THE SALT FOG STUDY ARE SHOWN IN FIGURES 2.5 AND 2.6

TABLE ICOATING SYSTEMS AND MARKING MATERIALS TESTED

<u>PANEL NO.</u>	<u>COATING SYSTEM</u>	<u>MARKING MATERIALS</u>
#1	Inorganic Zinc PCP Wash Primer Silicone Alkyd	(1) 30-34B Black Marker (2) Tempil Pyromarker Yellow (3) Tempil Pyromarker White (4) Tempil Pyromarker Aluminum
#2	Inorganic Zinc PCP Wash Primer Silicone Alkyd	(5) Nissen Orange (6) Nissen Yellow (7) Nissen White (8) Markal Paint Stick
#3	Inorganic Zinc PCP Wash Primer Silicone Alkyd	(9) Markal Squeeze Tube White (10) Markal Squeeze Tube Yellow (11) Penamark (12) Marsh T-Grade White (99 Marker)
#4	Inorganic Zinc PCP Wash Primer Silicone Alkyd	(13) Marsh T-Grade Yellow (99 Marker) (14) Carco - Orange - (99 Marker) (15) Carco - White - (99 Marker) (16) Dykem - Staining Yellow
#5	Inorganic Zinc PCP Wash Primer Silicone Alkyd	(17) Dykem Layout Orange (18) Dixon Redimark (19) Ameron Blue (20) Ameron Red
#6	Inorganic Zinc PCP Epoxy - 2 Pkgs.	(1) 30-34B Black Marker (2) Tempil Pyromarker Yellow (3) Tempil Pyromarker White (4) Tempil Pyromarker Aluminum
#7	Inorganic Zinc PCP Epoxy - 2 Pkgs.	(5) Nissen Orange (6) Nissen Yellow (7) Nissen White (8) Markal Paint Stick
#8	Inorganic Zinc PCP EPOXY - 2 Pkgs.	(9) Markal Squeeze Tube White (10) Markal Squeeze Tube Yellow (11) Penamark (12) Marsh T-Grade White (99 Marker)
#9	Inorganic Zinc PCP EPOXY - 2 Pkgs.	(13) Marsh T-Grade Yellow (99 Marker) (14) Carco Orange (99 Marker) (15) Carco White (99 Marker) (16) Dykem Staining Yellow

TABLE I - (Cond't.)

<u>PANEL NO.</u>	<u>COATING SYSTEM</u>	<u>MARKING MATERIALS</u>
#10	Inorganic Zinc PCP EPOXY - 2 Pkgs.	(17) Dykem Layout Orange (18) Dixon Redimark (19) Ameron Blue (20) Ameron Red
#11	Inorganic Zinc PCP Chlorinated Rubber	(1) 30-34B Black Marker (2) Tempil Pyromarker Yellow (3) Tempil Pyromarker White (4) Tempil Pyromarker Aluminum
#12	Inorganic Zinc PCP Chlorinated Rubber	(5) Nissen Orange (6) Nissen Yellow (7) Nissen White (8) Markal Paint Stick
#13	Inorganic Zinc PCP Chlorinated Rubber	(9) Markal Squeeze Tube White (10) Markal Squeeze Tube Yellow (11) Penamark (12) Marsh T-Grade White (99 Marker)
#14	Inorganic Zinc PCP Chlorinated Rubber	(13) Marsh T-Grade Yellow (99 Marker) (14) Carco Orange (99 Marker) (15) Carco White (99 Marker) (16) Dykem Staining Yellow
#15	Inorganic Zinc PCP Chlorinated Rubber	(17) Dykem Layout Orange (18) Dixon Redimark (19) Ameron Blue (20) Ameron Red
#16	Inorganic Zinc PCP One Pkg. Epoxy Silicone Alkyd	(1) 30-34B Black Marker (2) Tempil Pyromarker Yellow (3) Tempil Pyromarker White (4) Tempil Pyromarker Aluminum
#17	Inorganic Zinc PCP One Pkg. Epoxy Silicone Alkyd	(5) Nissen Orange (6) Nissen Yellow (7) Nissen White (8) Markal Paint Stick
#18	Inorganic Zinc PCP One Pkg. Epoxy Silicone Alkyd	(9) Markal Squeeze Tube White (10) Markal Squeeze Tube Yellow (11) Penamark (12) Marsh T-Grade White (99 Marker)
#19	Inorganic Zinc PCP One Pkg. Epoxy Silicone Alkyd	(13) Marsh T-Grade Yellow (99 Marker) (14) Carco Orange (99 Marker) (15) Carco White (99 Marker) (16) Dykem Staining Yellow

TABLE I - (Cond't.)

<u>PANEL NO.</u>	<u>COATING SYSTEM</u>	<u>MARKING MATERIALS</u>
#20	Inorganic Zinc PCP One Pkg. Epoxy Silicone Alkyd	(17) Dykem Layout Orange (18) Dixon Redimark (19) Ameron Blue (20) Ameron Red
#21	Inorganic Zinc PCP Aluminum Barrier Coat	(1) 30-34B Black Marker (2) Tempil Pyromarker Yellow (3) Tempil Pyromarker White (4) Tempil Pyromarker Aluminum
#22	Inorganic Zinc PCP Aluminum Barrier Coat	(5) Nissen Orange (6) Nissen Yellow (7) Nissen White (8) Markal Paint Stick
#23	Inorganic Zinc PCP Aluminum Barrier Coat	(9) Markal Squeeze Tube White (10) Markal Squeeze Tube Yellow (11) Penamark (12) Marsh T-Grade White (99 Marker)
#24	Inorganic Zinc PCP Aluminum Barrier Coat	(13) Marsh T-Grade Yellow (99 Marker) (14) Carco Orange (99 Marker) (15) Carco White (99 Marker) (16) Dykem Staining Yellow
#25	Inorganic Zinc PCP Aluminum Barrier Coat	(17) Dykem Layout Orange (18) Dixon Redimark (19) Ameron Blue (20) Ameron Red
#26	Inorganic Zinc PCP Inorganic Zinc	(1) 30-34B Black Marker (2) Tempil Pyromarker Yellow (3) Tempil Pyromarker White (4) Tempil Pyromarker Aluminum
#27	Inorganic Zinc PCP Inorganic Zinc	(5) Nissen Orange (6) Nissen Yellow (7) Nissen White (8) Markal Paint Stick
#28	Inorganic Zinc PCP Inorganic Zinc	(9) Markal Squeeze Tube White (10) Markal Squeeze Tube Yellow (11) Penamark (12) Marsh T-Grade White (99 Marker)
#29	Inorganic Zinc PCP Inorganic Zinc	(13) Marsh T-Grade Yellow (99 Marker) (14) Carco Orange (99 Marker) (15) Carco White (99 Marker) (16) Dykem Staining Yellow

TABLE I - (Cond't.)

<u>PANEL NO.</u>	<u>COATING SYSTEM</u>	<u>MARKING MATERIALS</u>
#30	Inorganic Zinc PCP Inorganic Zinc	(17) Dykem Layout Orange (18) Dixon Redimark (19) Ameron Blue (20) Ameron Red

2.2.2.1 RESULTS OF TESTS

TABLE 3 GIVES THE RESULTS OF TESTS THAT WERE PERFORMED ON MARKS EXPOSED TO THE ATMOSPHERE AT 45 DEGREES FACING SOUTH FOR A PERIOD OF 8.5 MONTHS, IN THIS TEST, MARKINGS WERE MADE OVER INORGANIC ZINC PRECONSTRUCTION PRIMER, WASH PRIMER, AND SINGLE PACKAGE EPOXY PRIMER. AGAIN, RATINGS BELOW 7 WERE CONSIDERED TO BE UNACCEPTABLE, OVER ZINC. PRECONSTRUCTION PRIMER SIXTEEN MARKINGS PERFORMED SATISFACTORILY. OVER SINGLE PACKAGE EPOXY TEN MARKINGS HELD UP AND, OVER WASH PRIMER, NINETEEN MARKINGS PROVED SATISFACTORILY.

RATINGS WERE BASED ON ADHESION TO THE PRIMER, VISIBILITY OF THE MARK AFTER BEING EXPOSED TO SUNLIGHT WAS ALSO A PRIME CRITERIA.

ONLY FOUR MARKINGS PERFORMED WELL IN BOTH SALT FOG TESTS AND THE EXTERIOR TESTS. THESE WERE THE TEMPIL PAINT MARKERS AND THE INORGANIC MATERIALS. MARKAL PAINT IN POLYETHYLENE BOTTLES PERFORMED

SATISFACTORILY IN ALL BUT ONE TEST, DURING PRODUCTION TRIAL THEY WORKED VERY WELL EXCEPT FOR TWO PROBLEMS, ONE WAS THAT THE SUPPLY OF MATERIAL WAS USED UP TOO QUICKLY AND) ON OVERHEADS WHEN THE FLUID SUPPLY WAS LOW THEY COULD NOT BE USED, HOWEVER, ONE ADVANTAGE OF THE BOTTLE WAS THE FACT THAT IT COULD BE REFILLED AND WAS REUSEABLE. THE MARSH T-GRADE PIGMENTED INKS PERFORMED EXCEPTIONALLY WELL OVER INORGANIC ZINC PRE-CONSTRUCTION PRIMERS AND UNDER INORGANIC ZINC FULL BUILD UP PRIMERS. THE MARKING MATERIAL MANUFACTURED IN-HOUSE BY NEWPORT NEWS SHIPBUILDING, PACKAGED BY NISSEN IN BALL POINT TUBES, PROVED QUITE SATISFACTORILY UNDER TEST, THIS MATERIAL HAS EXCELLENT WEATHERING CHARACTERISTICS AND IS TOPCOATABLE WITH ALL COATINGS EXCEPT INORGANIC ZINCS. IT IS NOT AFFECTED BY THE SOLVENTS CONTAINED IN HIGH PERFORMANCE COATINGS. FIGURE 2.7 ILLUSTRATES FLAKING EXPERIENCED IN SOME TESTS AFTER EXTERIOR

EXPOSURE WHILE FIGURE 2.8 SHOWS
FADING ON EXTERIOR EXPOSURE.



FIGURE 2.5 - TYPICAL SALT FOG FAILURE
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FIGURE 2.6 - TYPICAL SALT FOG FAILURE

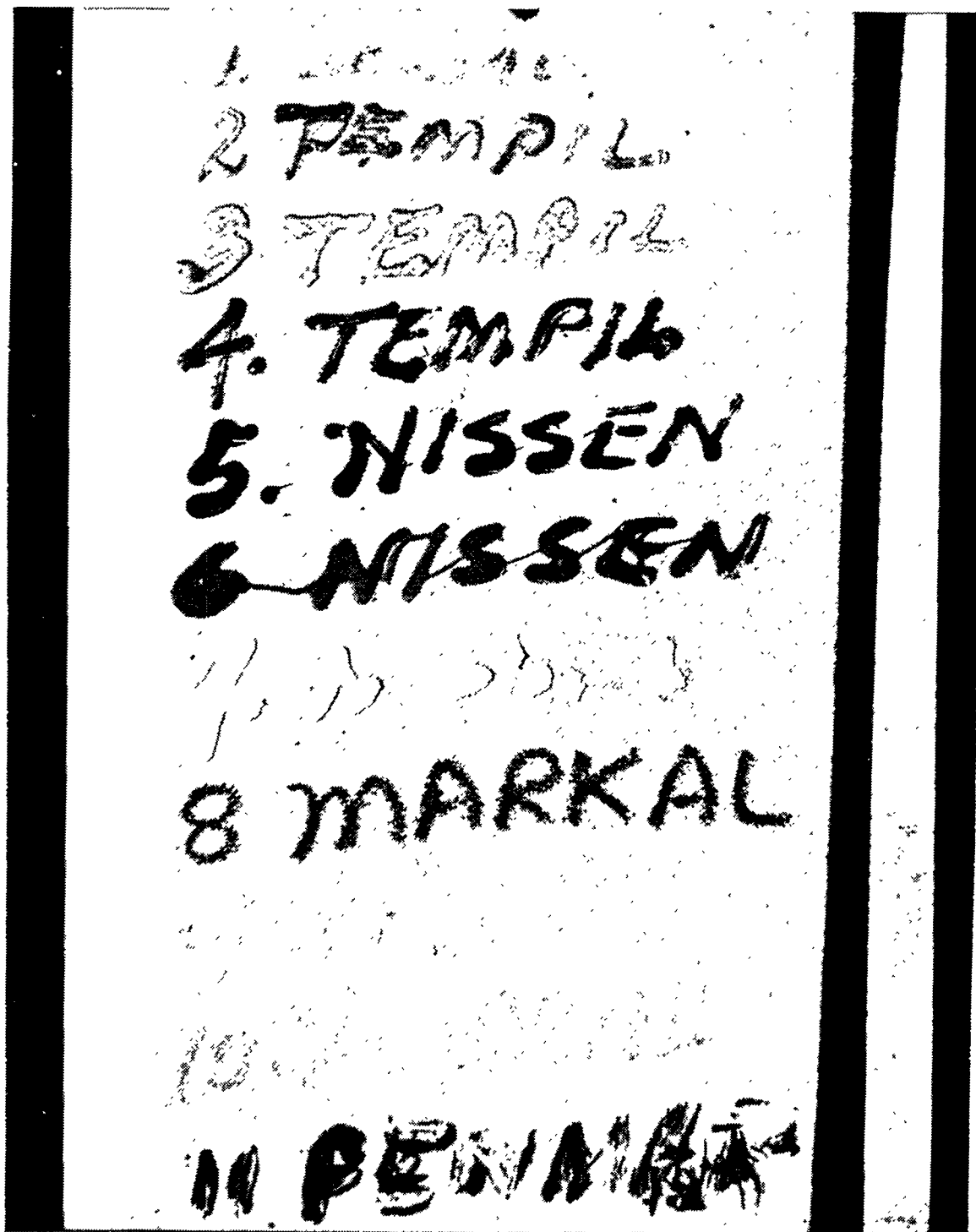


FIGURE 2.7 - FADING ON EXTERIOR EXPOSURE



FIGURE 2.8 - FLAKING ON EXTERIOR EXPOSURE



TABLE 2

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SALT FOG EXPOSURE

TABLE 2 CONT'D.

MANUFACTURER	TOPCOAT MATERIALS	PANEL NO.	RATING	ACCEPTABLE	UNACCEPTABLE
Markal	Wash Primer/Silicone Alkyd	3-9	8	X	
Poly-Bottle	Catalyzed Epoxy	8-9	7	X	
Paint-White	Chlorinated Rubber	13-9	2		X
	Single Pkg.Epoxy/Silicone Alkyd	18-9	9	X	
	Aluminum Barrier Coat	23-9	8	X	
	Inorganic Zinc	28-9	8	X	
Markal	Wash Primer/Silicone Alkyd	3-10	8	X	
Poly-Bottle	Catalyzed Epoxy	8-10	7	X	
Paint-Yellow	Chlorinated Rubber	13-10	3		X
	Single Pkg.Epoxy/Silicone Alkyd	18-10	8	X	
	Aluminum Barrier Coat	23-10	7	X	
	Inorganic Zinc	28-10	8	X	
Pennamark	Wash Primer/Silicone Alkyd	3-11	6		X
Stain	Catalyzed Epoxy	8-11	4		X
	Chlorinated Rubber	13-11	3		X
	Single Pkg.Epoxy/Silicone Alkyd	18-11	7	X	
	Aluminum Barrier Coat	23-11	8	X	
	Inorganic Zinc	28-11	7	X	
Marsh	Wash Primer/Silicone Alkyd	3-12	10	X	
T-Grade	Catalyzed Epoxy	8-12	7	X	
Pigmented Ink	Chlorinated Rubber	13-12	3		X
White	Single Pkg.Epoxy/Silicone Alkyd	18-12	5		X
	Aluminum Barrier Coat	23-12	8	X	
	Inorganic Zinc	28-12	10	X	
Marsh	Wash Primer/Silicone Alkyd	4-13	8	X	
T-Grade	Catalyzed Epoxy	9-13	6		X
Pigmented Ink	Chlorinated Rubber	14-13	3		X
Yellow	Single Pkg.Epoxy/Silicone Alkyd	19-13	6		X
	Aluminum Barrier Coat	24-13	0		X
	Inorganic Zinc	29-13	10	X	
Carco	Wash Primer/Silicone Alkyd	4-14	2		X
Orange	Catalyzed Epoxy	9-14	6		X
Ink	Chlorinated Rubber	14-14	3		X
	Single Pkg.Epoxy/Silicone Alkyd	19-14	9	X	
	Aluminum Barrier Coat	24-14	2		X
	Inorganic Zinc	29-14	7	X	
Carco	Wash Primer/Silicone Alkyd	4-15	4		X
White	Catalyzed Epoxy	9-15	8	X	
Ink	Chlorinated Rubber	14-15	5		X
	Single Pkg.Epoxy/Silicone Alkyd	19-15	10	X	
	Aluminum Barrier Coat	24-15	8	X	
	Inorganic Zinc	29-15	10	X	
Dykem	Wash Primer/Silicone Alkyd	4-16	5		X
Yellow	Catalyzed Epoxy	9-16	5		X
Stain	Chlorinated Rubber	14-16	4		X
	Single Pkg.Epoxy/Silicone Alkyd	19-16	9	X	
	Aluminum Barrier Coat	24-16	6		v



TABLE 2 - (CONT'D.)

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Salt Fog Exposure

Table 3

Panel No.	Coating System	Mark No.	Marking Material	72 Hours	240 Hours	330 Hours	1128 Hours	2500 Hours	Adhesion at 2500 Hrs
1	Inorganic Zinc PCP	1	30-34 B Black Marker	10	10	10	10	10	Exc.
	Marking Material	2	Tempil Pyromarker Yellow	10	10	10	10	9 Corrosion	Good
	Wash Primer	3	Tempil Pyromarker White	10	10	10	10	9 Corrosion	Good
	Silicone Alkyd	4	Tempil Pyromarker Aluminum	10	10	10	9 Corrosion	7 Corrosion	Fair
2	Inorganic Zinc PCP	5	Nissen Orange	10	10	10	10	10	Good
	Marking Material	6	Nissen Yellow	10	10	10	10	10	Good
	Wash Primer	7	Nissen White	10	10	10	10	10	Good
	Silicone Alkyd	8	Markal Paint Stick	9 Blisters	9	9	8 Corrosion	6 Corrosion	Poor
3	Inorganic Zinc PCP	9	Markal PolyBottle White	10	10	10	10	8	Fair
	Marking Material	10	Markal PolyBottle Yellow	10	10	10	10	8	Fair
	Wash Primer	11	Penamark	10	10	10	10	6	Poor
	Silicone Alkyd	12	Marsh T-Grade White	10	10	10	10	10	Very Go
4	Inorganic Zinc PCP	13	Marsh T-Grade Yellow	10	10	10	10	8 Corrosion	Very Go
	Marking Material	14	Carco-Orange	10	10	10	10	2 Blist. & Cor.	Fair
	Wash Primer	15	Carco-White	10	10	10	10	4 Blist. & Cor.	Fair
	Silicone Alkyd	16	Dykem-Staining Yellow	10	10	10	10	5 Blist. & Cor.	Fair
5	Inorganic Zinc PCP	17	Dykem Layout Orange	10	10	10	10	10	Good
	Marking Material	18	Dixon Redimark	10	10	10	10	8	Good
	Wash Primer	19	Ameron Inorganic Blue	10	10	10	10	9	Good
	Silicone Alkyd	20	Ameron Inorganic Red	10	10	9	8	8 Cracking	Good
6	Inorganic Zinc PCP	1	30-34 B Black Marker	10	10	10	10	10	Good
	Marking Material	2	Tempil Pyromarker Yellow	10	10	10	10	8 Corrosion	Good
	Catalyzed Epoxy	3	Tempil Pyromarker White	10	10	10	10	8 Corrosion	Good
		4	Tempil Pyromarker Aluminum	10	10	10	10	8 Corrosion	Good
7	Inorganic Zinc PCP	5	Nissen Orange	10	10	10	10	7	Poor
	Marking Material	6	Nissen Yellow	10	10	10	10	8 Corrosion	Fair
	Catalyzed Epoxy	7	Nissen White	10	10	10	10	8	Fair
		8	Markal Paint Stick	9 Blisters	9	9	9	6	Poor
8	Inorganic Zinc PCP	9	Markal PolyBottle White	10	10	10	10	7	Poor
	Marking Material	10	Markal Polybottle Yellow	10	10	10	8 Blisters	7	Poor
	Catalyzed Epoxy	11	Penamark	10	9 Sl. Blist.	8	8	4	Very Po
		12	Marsh T-Grade White	10	10	10	8 Blisters	7	Poor
9	Inorganic Zinc PCP	13	Marsh T-Grade Yellow	10	10	10	9 Blisters	6 Corrosion	Fair
	Marking Material	14	Carco-Orange	10	10	10	10	6 Blisters	Poor
	Catalyzed Epoxy	15	Carco-White	10	10	10	8 Blisters	8	Fair
		16	Dykem-Staining Yellow	10	10	9	8 Blisters	5 Corrosion	Fair
10	Inorganic Zinc PCP	17	Dykem Layout Orange	10	10	10	8 Blisters	8	Good
	Marking Material	18	Dixon Redimark	10	10	9 Bleed Thru	8 Blisters	8	Good
	Catalyzed Epoxy	19	Ameron Inorganic Blue	10	10	10	8 Blisters	8	Good
		20	Ameron Inorganic Red	10	9	9	8 Blisters	8	Fair
11	Inorganic Zinc PCP	1	30-34 B Black Marker	10	10	10	10	10	Good
	Marking Material	2	Tempil Pyromarker Yellow	10	10	10	10	7 Flaking	Fair
	Chlorinated Rubber	3	Tempil Pyromarker White	10	10	10	10	7 Flaking	Fair

SALT FOG EXPOSURE

TABLE 3 CONT'D.

PANEL NO.	COATING SYSTEM	MARK NO.	MARKING MATERIAL	72	HOURS	240	HOURS	330	HOURS	1128	HOURS	2500	HOURS	ADHES AT 2500
12	Inorganic Zinc PCP	5	Nissen Orange	10		10		10		8 Chipping		3 Flaking		Poo
	Marking Material	6	Nissen Yellow	10		10		10		10		3 Flaking		Poo
	Chlorinated Rubber	7	Nissen White	8						5 Chipping		3 Flaking		Poo
		8	Markal Paint Stick	10			7 Lifting	7 Blisters		4 Mark Lifted		3 Flaking		Poo
13	Inorganic Zinc PCP	9	Markal Poly Bottle White	10		10		8		2		2 Flaking		Poo
	Marking Material	10	Markal Poly Bottle Yellow	10		10		8		4		3 Flaking		Poo
	Chlorinated Rubber	11	Penamark	10		8 Bleed Thru		7		3 Corrosion		3 Flaking		Fai
		12	Marsh T-Grade White	10		10		10		3		3 Flaking		Poo
14	Inorganic Zinc PCP	13	Marsh T-Grade Yellow	10		10		8 Chipping		3 Flaking		3 Flaking		Poo
	Marking Material	14	Carco Orange	10		10		10		9 Chipping		3 Flaking		Poo
	Chlorinated Rubber	15	Carco White	10		10		10		7 Flaking		5 Flaking		Fai
		16	Dykem Staining Yellow	10		8		8		7 Flaking		4 Flaking		Poo
15	Inorganic Zinc PCP	17	Dykem Layout Orange	10		10		10		5 Blisters		5 Corrosion		Fai
	Marking Material	18	Dixon Redimark	10		10		10		10		10		Goo
	Chlorinated Rubber	19	Ameron Inorganic Blue	10		9		9		8 Blisters		8		Goo
		20	Ameron Inorganic Red	10		9		9		8 Blisters		8		Goo
16	Inorganic Zinc PCP	1	30-34B Black Marker	10		10		10		10		9 Bleed Thru		Very
	Marking Material	2	Tempil Pyromarker Yellow	10		10		10		8 Chipping		7		Fai
	Single Package Epoxy	3	Tempil Pyromarker White	10		10		10		8 Chipping		8		Goo
	Silicone Alkyd	4	Tempil Pyromarker Aluminum	10		10		9		8 Chipping		8		Goo
17	Inorganic Zinc PCP	5	Nissen Orange	10		10		10		7 Cracking		4 Flaking		Poo
	Marking Material	6	Nissen Yellow	10		10		10		7 Blisters		5 Flaking		Fai
	Single Package Epoxy	7	Nissen White	8 Lifting		7 Blisters		3 Lifting		0 Corrosion		0 Flaking		Very
	Silicone Alkyd	8	Markal Paint Stick	10		8 Blisters		5 Cracking		1		1 Flaking		Poo
18	Inorganic Zinc PCP	9	Markal Poly Bottle White	10		10		10		9		9		Goo
	Marking Material	10	Markal Poly Bottle Yellow	10		10		10		8 Corrosion		8		Goo
	Single Package Epoxy	11	Penamark	8 Blisters		7		7		7 Chipping		7		Fai
	Silicone Alkyd	12	Marsh T-Grade White	10		10		10		10		5 Flaking		Poo
19	Inorganic Zinc PCP	13	Marsh T-Grade Yellow	10		10		10		8 Chipping		6 Cracking		Fai
	Marking Material	14	Carco Orange	10		10		10		9 Chipping		9		Goo
	Single Package Epoxy	15	Carco White	10		10		10		10		10		Goo
	Silicone Alkyd	16	Dykem Staining Yellow	10		10		10		10		9		Goo
20	Inorganic Zinc PCP	17	Dykem Layout Orange	10		10		10		7 Blistering		7		Goo
	Marking Material	18	Dixon Redimark	10		10		9		9 Bleeding		8		Goo
	Single Package Epoxy	19	Ameron Inorganic Blue	10		10		10		10		10		Goo
	Silicone Alkyd	20	Ameron Inorganic Red	10		10		9		8 Cracking		8		Goo
21	Inorganic Zinc PCP	1	30-34B Black Marker	10		10		10		10		10		Goo
	Marking Material	2	Tempil Pyromarker Yellow	10		10		10		10		8		Goo
	Aluminum Barrier Coat	3	Tempil Pyromarker White	10		10		10		10		8		Goo
		4	Tempil Pyromarker Aluminum	10		10		10		10		9		Goo
22	Inorganic Zinc PCP	5	Nissen Orange	10		10		10		10		6		Poo
	Marking Material	6	Nissen Yellow	10		10		10		10		6		Poo
	Aluminum Barrier Coat	7	Nissen White	10		10		10		10		6		Poo
		8	Markal Paint Stick	10		9		9		8 Chipping		6		Poo



SALT FOG EXPOSURE

TABLE 3 CONTINUED

PANEL NO.	COATING SYSTEM	MARK NO.	MARKING MATERIAL	72	HOURS	240	HOURS	330	HOURS	1128	HOURS	2500	HOURS	ADHESION AT 2500 HOURS
23	Inorganic Zinc PCP	9	Markal PolyBottle White	10		10		10		10		8		Fair
	Marking Material	10	Markal PolyBottle Yellow	10		10		10		10		7		Poor
	Aluminum Barrier Coat	11	Penamark	10		9		9		8		8		Good
		12	Marsh T-Grade White	10		10		10		8		8		Fair
24	Inorganic Zinc PCP	13	Marsh T-Grade Yellow	10		10		10		0 Major Blist.		0		Poor
	Marking Material	14	Carco-Orange	10		10		10		2 Major Blist.		2		Poor
	Aluminum Barrier Coat	15	Carco-White	10		10		10		8 Sl. Blist.		8		Good
		16	Dykem - Staining Yellow	10		10		10		8		6		Poor
25	Inorganic Zinc PCP	17	Dykem Layout Orange	10		10		10		6 Sl. Blist.		6		Fair
	Marking Material	18	Dixon Redimark	10		10		10		8		8		Good
	Aluminum Barrier Coat	19	Ameron Inorganic Blue	10		10		10		8		8		Good
		20	Ameron Inorganic Red	10		10		10		8		8		Good
26	Inorganic Zinc PCP	1	30-34 B Black Marker	10		10		10		10		10		Good
	Marking Material	2	Tempil Pyromarker Yellow	10		10		8		6 Mod. Chipped		6		Poor
	Inorganic Zinc	3	Tempil Pyromarker White	10		10		10		7 Sl. Chipped		7		Poor
		4	Tempil Pyromarker Aluminum	10		10		10		10		8		Fair
27	Inorganic Zinc PCP	5	Nissen Orange	10		10		8 Sl. Flaking		7		3 Major Flak.		Very I
	Marking Material	6	Nissen Yellow	10		10		10		9		6 Sl. Flaking		Fair
	Inorganic Zinc	7	Nissen White	10		10		9 Sl. Flaking		8		3 Major Flak.		Poor
		8	Markal Paint Stick	10		10		9 Sl. Flaking		7		4 Major Flak.		Poor
28	Inorganic Zinc PCP	9	Markal PolyBottle White	10		10		9 Sl. Chipped		9		8		Good
	Marking Material	10	Markal PolyBottle Yellow	10		10		9 Sl. Chipped		9		8		Good
	Inorganic Zinc	11	Penamark	10		10		9 Sl. Chipped		9		7		Fair
		12	Marsh T-Grade White	10		10		10		10		10		Very C
29	Inorganic Zinc PCP	13	Marsh T-Grade Yellow	10		10		10		10		10		Very C
	Marking Material	14	Carco-Orange	10		10		9		8		7		Fair
	Inorganic Zinc	15	Carco-White	10		10		10		10		10		Very C
		16	Dykem-Staining Yellow	10		10		10		10		10		Very C
30	Inorganic Zinc PCP	17	Dykem Layout Orange	10		10		10		10		10		Very C
	Marking Material	18	Dixon Redimark	10		10		10		10		10		Very C
	Inorganic Zinc	19	Ameron Inorganic Blue	10		10		10		10		10		Very C
		20	Ameron Inorganic Red	10		10		10		9		9		Good



EXTERIOR EXPOSURE

TABLE 4

TABLE NO.	MARKING MATERIAL	EXPOSURE FOR FOUR MONTHS				EXPOSURE FOR EIGHT AND ONE-HALF MONTHS				ACCEPT- ABLE	UNACCEPT- ABLE
1	30-34 Black Marker Over:										
	Inorganic Zinc PCP	7	Mod. Faded			4	Badly Faded			X	X
	Vinyl Butyral Wash Primer	9	Sl. Faded			8					
	Single Package Epoxy	8	Sl. Faded			6	Mod. Faded				X
2	Tempil Pyromarker Yellow Over:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	"			10	"			X	
	Single Package Epoxy	10	"			10	"			X	
3	Tempil Pyromarker White Over:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	"			10	"			X	
	Single Package Epoxy	10	"			10	"			X	
4	Tempil Pyromarker Aluminum Over:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	"			10	"			X	
	Single Package Epoxy	10	"			10	"			X	
5	Nissen Orange Over:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	"			10	"			X	
	Single Package Epoxy	10	"			10	"			X	
6	Nissen Yellow Over:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	"			10	"			X	
	Single Package Epoxy	10	"			10	"			X	
7	Nissen White Over:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	"			10	"			X	
	Single Package Epoxy	10	"			3	Chipped - Poor Adhesion				X
8	Markal Paint Stick Over:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	"			10	"			X	
	Single Package Epoxy	10	"			10	"			X	
9	Markal Poly Bottle White:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	Excellent			10	Excellent			X	
	Single Package Epoxy	7	Sl. Flaked			3	Flaked - Poor Adhesion				X
10	Markal Poly Bottle Yellow:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	"			10	"			X	
	Single Package Epoxy	10	"			3	Flaked - Poor Adhesion				X
11	Penamark Over:										
	Inorganic Zinc PCP	8	Sl. Faded			5	Badly Faded			X	X
	Vinyl Butyral Wash Primer	10	Excellent			8	Sl. Faded				X
	Single Package Epoxy	7	Mod. Faded			3	Badly Faded				



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EXTERIOR EXPOSURE

TABLE 4 - (CONT'D.)

PANEL NO.	MARKING MATERIAL	EXPOSURE FOR FOUR MONTHS				EXPOSURE FOR EIGHT AND ONE-HALF MONTHS				ACCEPTABLE	UNACCEPTABLE
12	Marsh T-Grade White over:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	Excellent			10	Excellent			X	
	Single Package Epoxy	7	Cracked, Sl. Flaked			0	Flaked and Faded				
13	Marsh T-Grade Yellow over:										X
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	Excellent			10	Excellent			X	
	Single Package Epoxy	10	Excellent			7	Faded			X	
14	Carco Orange over:										
	Inorganic Zinc PCP	10	Excellent			8	Sl. Faded			X	
	Vinyl Butyral Wash Primer	10	Excellent			8	Sl. Faded			X	
	Single Package Epoxy	10	Excellent			7	Faded			X	
15	Carco White over:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	Excellent			10	Excellent			X	
	Single Package Epoxy	10	Excellent			4	Faded				X
16	Dykem Staining Yellow										
	Inorganic Zinc PCP	8	Faded			7	Faded			X	
	Vinyl Butyral Wash Primer	10	Excellent			10	Excellent			X	
	Single Package Epoxy	10	Excellent			7	Faded			X	
17	Dykem Layout Orange										
	Inorganic Zinc PCP	0	Completely Faded			0	Completely Faded				X
	Vinyl Butyral Wash Primer	0	Completely Faded			0	Completely Faded				X
	Single Package Epoxy	5	Faded			0	Completely Faded				X
18	Dixon Redimark over:										
	Inorganic Zinc PCP	0	Completely Faded			0	Completely Faded				X
	Vinyl Butyral Wash Primer	8	Sl. Faded			7	Faded			X	
	Single Package Epoxy	3	Faded and Discolored			0	Completely Faded				X
19	Ameron Inorganic Blue over:										
	Inorganic Zinc PCP	10	Excellent			10	Excellent			X	
	Vinyl Butyral Wash Primer	10	Excellent			10	Excellent			X	
	Single Package Epoxy	10	Excellent			8	Sl. Chipped			X	
20	Ameron Inorganic Red over:										
	Inorganic Zinc PCP	9	Sl. Flaked			8	Sl. Faded			X	
	Vinyl Butyral Wash Primer	10	Excellent			10	Excellent			X	
	Single Package Epoxy	8	Sl. Flaked			6	Flaked				X